REMARKS

The foregoing Amendment corrects translational errors and conforms the claims to United States practice. No new matter is added.

Respectfully submitted,

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Date: January 10, 2002
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PATENT
Attorney Docket No. 401527/MELCO

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

YASUDA et al.

Art Unit: Unassigned

Application No. Unassigned

Examiner: Unassigned

Filed: January 10, 2002

For: SENSOR ELEMENT AND METHOD OF FABRICATING THEREOF

AMENDMENTS TO SPECIFICATION, CLAIMS AND ABSTRACT MADE VIA PRELIMINARY AMENDMENT

Amendments to the paragraph beginning at page 1, line 4:

The present invention relates to a sensor element, particularly to a sensor such as a magnetoresistance sensor, an air flow sensor, an acceleration sensor, a pressure sensor, a yaw rate sensor, an image sensor, or the like, having a ~~predetermined extent of~~ sensor face.

Amendments to the paragraph beginning at page 1, line 10:

As a sensor element for controlling the running of vehicles, there have been used an acceleration sensor, a yaw rate sensor, a pressure sensor, an air flow sensor, a magnetoresistance sensor or the like. Among them, the air flow sensor for detecting a flow rate of gasoline is in such a constitution that, for example, temperature variation at the sensing portion in which resistance wiring is embedded caused by contacting ~~to~~ the flow path of gasoline-containing gas is detected by the change of resistance of the resistance wiring whereby the flow rate of the gasoline-containing gas can be detected. The sensing portion is formed on a lower supporting film comprising an inorganic material such as a silicon nitride film supporting the sensing portion. The inorganic material is usually formed ~~by~~ in a sputtering process, a CVD process, or a vapor deposition process and, therefore, film quality such as ~~a~~ microscopic surface roughness and a film composition delicately changes depending upon apparatus and ~~condition~~ conditions for the formation of film. Due to the changes in the film quality as such, there are noted dispersion of several % in sensor characteristic (such as sensitivity) whereby it has been difficult to achieve a stable sensor characteristic with ~~a~~ good reproducibility. There are other problems that, due to the stress difference between the sensing portion and the inorganic material, the sensor characteristic is

deteriorated or a positional shift is caused in the resistance wiring constituting the sensing portion or a wiring on a contiguous control circuit. Particularly, in the case of a sensor in which ~~the~~ wiring, such as ~~a~~ resistance wiring, is used for the sensing portion, depending on the ~~constituting~~ materials used for the wiring, adherence with a matrix material is significantly weak~~; for example, when~~. When the sensor element is sealed by a resin, there poses a problem that ~~such a~~ the wiring is liable to ~~cause the~~ experience a positional shift ~~by~~ due to thermal or mechanical strain.

Amendments to the paragraph beginning at page 5, line 9:

Figs. 3A~~-~~ and 3B are ~~a~~ drawings which ~~illustrates~~ illustrate the structure of the air flow sensor of Example 1 according to the present invention where Fig. 3A is a ~~plane~~ plan view and Fig. 3B is a cross-sectional view along the line ~~A-A~~ IIIB-IIIB of Fig. 3A.

Amendments to existing claims:

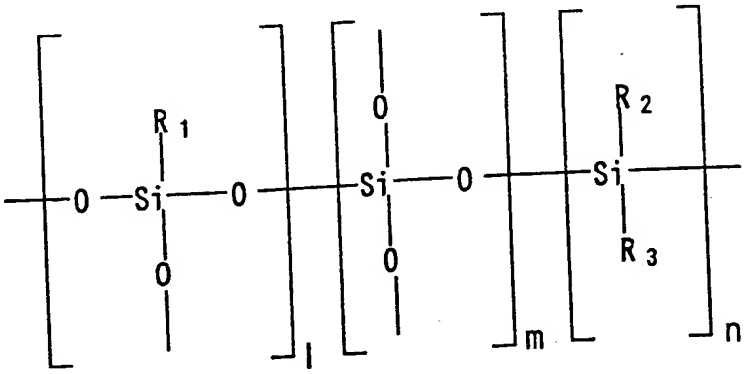
1. (Amended) A sensor element comprising~~:~~
sensor substrate;~~and~~
a sensing portion supported by the sensor substrate; and
~~wherein~~ a resin film ~~is provided~~ between the sensor substrate and the sensing portion.

3. (Amended) The sensor element according to claim 2, wherein the microfine wiring pattern comprises plural wiring patterns ~~being~~ adjacent each other.

4. (Amended) The sensor element according to claim 1, wherein the resin film is a cured ~~film of a curing~~ polymer film selected from ~~a~~ the group consisting of silicone ~~polymer~~ polymers, ~~a~~ polyimide ~~polymer~~ polymers, ~~a~~ polyimide silicone ~~polymer~~ polymers, ~~a~~ polyarylene ether ~~polymer~~ polymers, ~~a~~ bisbenzocyclobutene ~~polymer~~ polymers, ~~a~~ polyquinoline, ~~a~~ perfluorohydrocarbon, ~~a~~ fluorocarbon ~~polymer~~ polymers, and ~~an~~ aromatic hydrocarbon ~~polymer~~ polymers.

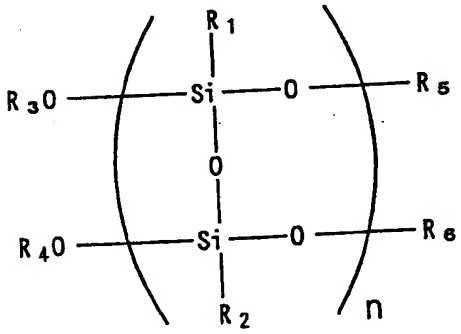
5. (Amended) The sensor element according to claim 4, wherein the ~~curing~~ polymer is a photo-curing polymer.

6. (Amended) The sensor element according to claim 1, wherein the ~~resin film is a~~ cured polymer film ~~of the~~ is a silicone polymer represented by the general formula (1)~~:~~



wherein R_1, R_2, and R_3, ~~which~~ may be the same or different, ~~each is~~ are selected from the group consisting of an aryl group, a hydrogen atom, an aliphatic alkyl group, a hydroxyl group, a trialkylsilyl group ~~or~~, and a functional group having an unsaturated bond~~; and~~, l, m, and n are integers and at least 0~~;~~, and the silicone polymer has a weight-average molecular weight of not less than 1,000.

7. (Amended) The sensor element according to claim 1, wherein the resin film is a cured film of ~~the~~ a silicone polymer represented by the general formula ~~(2);~~



wherein R_1 and R_2, ~~which~~ may be same or different, ~~each is~~ and are selected from the group consisting of an aryl group, a hydrogen atom, an aliphatic alkyl group ~~or~~, and a functional group having an unsaturated bond~~;~~, R_3, R_4, R_5, and R_6, ~~which~~ may be same or different, ~~each is~~ and are selected from the group consisting of a hydrogen atom, an aryl group, an aliphatic alkyl group, a trialkylsilyl group ~~or~~, and a functional group having an unsaturated bond~~;~~, and n is an integer~~;~~, and the silicone polymer has a weight-average molecular weight of not less than 1,000.

8. (Amended) The sensor element according to claim 4, wherein the resin film comprises ~~layered film comprising~~ plural layers and each of the layers comprises a cured polymer film of a different ~~curing~~ cured polymer.

9. (Amended) The sensor element according to claim 8, wherein each of the ~~layered film~~ layers comprises a cured ~~film of curing~~ polymer having different molecular weight.

10. (Amended) The sensor element according to claim 9, wherein the ~~layered film is composed of~~ layers include a layer of a cured polymer film comprising a silicone polymer having a weight-average molecular weight of not less than 100,000 and a layer of a cured polymer film comprising a silicone polymer having a weight-average molecular weight of not more than 100,000.

11. (Amended) The sensor element according to claim 8, wherein ~~the~~ an uppermost layer of the ~~layered film comprising plural~~ layers comprises a cured polymer film of a photo-curing polymer.

12. (Amended) The sensor element according to claim 1, wherein the sensor element is selected from the group consisting of a magnetoresistance sensor, an air flow sensor, an acceleration sensor, a pressure sensor, a yaw rate sensor ~~or~~, and an image sensor.

13. (Amended) A method of fabricating a sensor element, comprising ~~a step of coating~~:

applying a solution ~~of~~ including a thermosetting polymer ~~on~~ to a sensor substrate to form a ~~curing~~ polymer film~~, a step of~~;

heating the ~~curing~~ polymer film ~~at temperatures which are~~ to a temperature not lower than a fusing temperature and ~~are~~ lower than a curing temperature of the thermosetting polymer~~, a step of~~;

heating ~~thereof at~~ the polymer film to a temperature ~~of~~ not lower than the curing temperature to ~~form a cured~~ cure the resin film; and ~~a step of~~

forming a ~~desired sensing portion~~ sensor element on the ~~cured~~ resin film after curing of the resin film.

14. (Amended) The method of fabricating a sensor element according to claim 13, wherein the thermosetting polymer is selected from the group consisting of a silicone polymer, a polyimide polymer, a polyimide silicone polymer, a polyarylene ether polymer, a bisbenzocyclobutene polymer, a polyquinoline polymer, a perfluorohydrocarbon polymer, a fluorocarbon polymer ~~or~~, and an aromatic hydrocarbon polymer.

Amendments to the abstract:

Abstract

The present invention provides a sensor element having a sensor substrate and a sensing portion supported by the sensor substrate ~~in which a~~. A resin film is provided between the sensor substrate and the sensing portion. The resin film has a high heat resistance to the temperature ~~at~~ of the fabrication process and ~~for~~ the use of sensor element, has ~~an~~ excellent coverage ~~performance~~ of ~~an undercoat having~~ a three-dimensional structure, ~~can be made its~~ has a flat surface ~~flat, has~~ applies a low stress ~~applied~~ to the sensing portion, ~~can be~~ is formed at low temperature, and ~~can prevent~~ prevents the sensing portion from being adversely affected in ~~the~~ its fabrication process.